November 29, 2011

Public Workshop

for

DRAFT
Urban Levee Design Criteria
November 15, 2011

Welcome

- Draft ULDC
- Collaboratively developed
- Oral and written comments today
- Written comments due December 15, 2011
- Collaboratively address comments
- Comments used for ULDC
- Handouts

Senate Bill 5

- Requires urban level of protection by about 2015, or adequate progress thereafter
- Urban level of protection is 200-year level of protection using criteria consistent with, or developed by, DWR
- Applies to urban areas (10,000 people) and urbanizing areas (10,000 within 10 years)
- Without urban level of protection or adequate progress, no further development permitted in 200-year floodplain in Sacramento-San Joaquin Valley
- “Adequate progress” not available after 2025 for areas protected by State-federal project levees

ULDC Development

- DWR has released the following versions of the Interim Levee Design Criteria (ILDC) and ULDC:
  - First Draft ILDC, December 7, 2007 (8 pgs)
  - Second Draft ILDC, August 22, 2008 (15 pgs)
  - Third Draft ILDC, May 15, 2009 (20 pgs)
  - Version 4 ILDC, December 15, 2010 (53 pgs)
  - Draft ULDC, November 15, 2011 (77 pgs)

Key Changes from ILDC Version 4

- Statewide application
- An Introduction was added
- New topics introduced
- Expanded criteria and guidance on some topics
- Attached draft procedural criteria

ULDC and Related Criteria

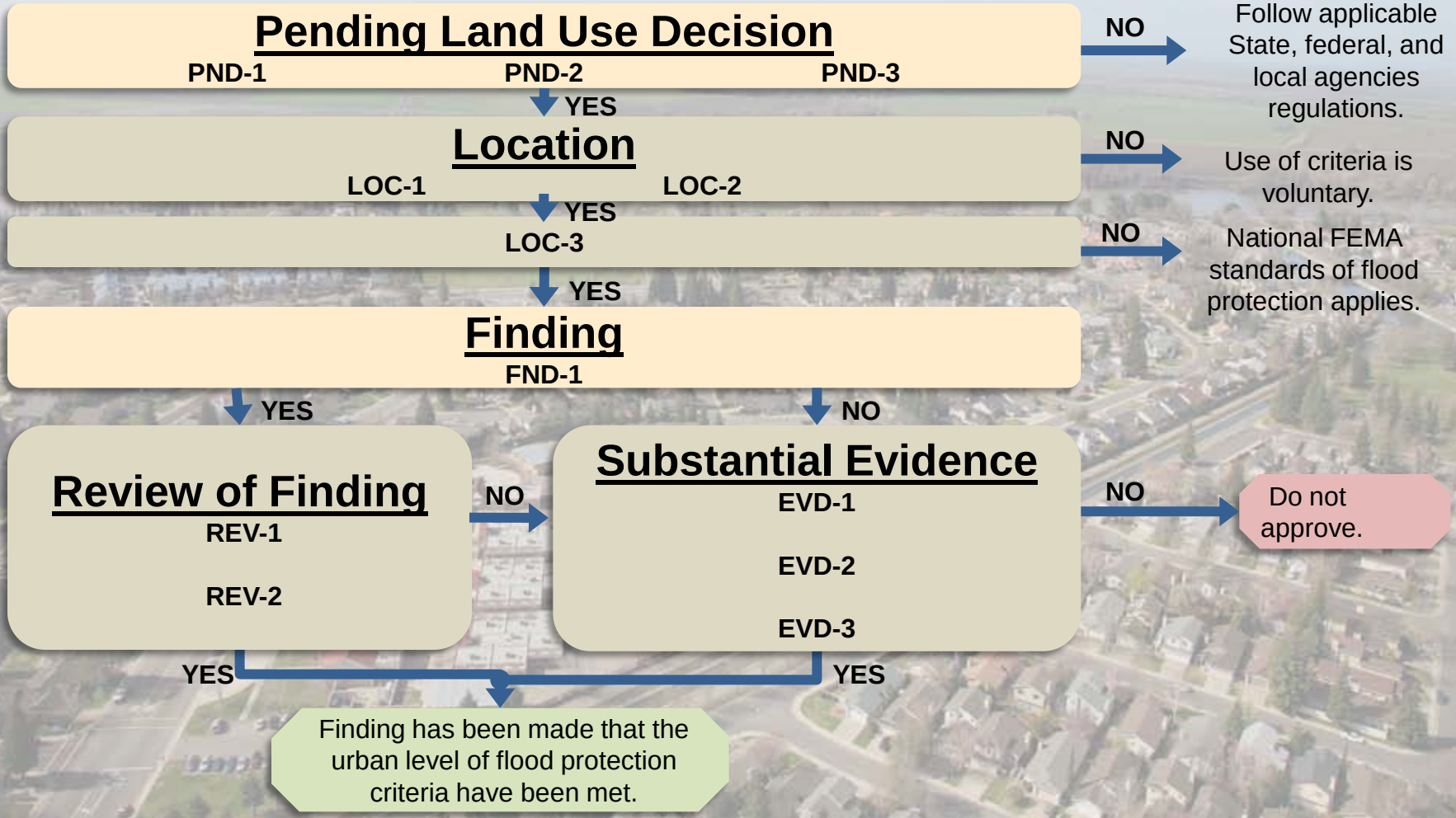
- Criteria for Demonstrating Urban Level of Flood Protection (ULOP)
  - overall procedure for compliance with SB 5
  - collaborative stakeholder process
  - development of ULOP temporarily suspended
  - ULDC covers portion pertaining to levees/floodwalls
  - may be added to California Code of Regulations
- Title 23 California Code of Regulations
  - applies to levees regulated by CVFPB (including nonurban)
- Central Valley Flood Protection Plan
  - references ULDC
  - Conservation Framework

FloodSAFE CALIFORNIA

Draft ULOP Document Overview

Detailed Sequential and Conditional Criteria

Guidance for cities and counties making land use decisions



Questions / Comments?

ULDC Work Group

- About 25 members from counties, flood control agencies, DWR, CVFPB, Cal EMA, and the Army Corps of Engineers
- Added 2 members from outside of the Central Valley
- Seven facilitated work group meetings between March 2011 and September 2011

ULDC Work Group

- Collaborative approach allowed DWR to draw on the expertise of those responsible for implementing the criteria
- Members volunteered to draft new sections for review by the group, often working in small teams
- Some members participated in ULOP work group
- Thanks to members and their sponsors!

ULDC Table of Contents Overview

Note: New sections shown in *red italics*

1.0 Introduction

- Background
- What document does (engineering criteria)
- What document does not do (environmental compliance)
- Encouragement to integrate projects to include multiple purposes
- How a finding may include part of a levee system
- Encouragement to address residual risk

2.0 Purpose

Provide analytical (and draft procedural) criteria for civil engineers, cities, and counties to follow in meeting the requirements of California's Government Code Sections 65865.5, 65962, and 66474.5 with respect to finding that levees and floodwalls provide protection against a flood that has a 1-in-200 chance of occurring in any given year.

3.0 Definitions

- Assurance
- Flood risk
- Hydraulic top of levee
- Level of (flood) protection
- Minimum top of levee
- Penetration
- Vegetation management zone

4.0 Need

- Compliance with SB5 for levee and floodwall design
- Criteria and guidance for:
  - Evaluations of Project and Non-Project levees in urban and urbanizing areas
  - Guidance for urban and urbanizing area levee designs to be initiated/completed in the near future
  - Eligibility criteria for urban EIP grant funding
  - Assisting local agencies in achieving FEMA 100-yr flood protection
  - Assisting local agencies in achieving the urban level of flood protection (200-yr)
  - Planning studies, such as the Central Valley Flood Protection Plan (CVFPP)

5.0 Background

- Two commonly used approaches for Design Water Surface Elevation (DWSE)
  - FEMA Approach – Deterministic
  - Corps Approach - Conditional Risk and Uncertainty
- Central Valley levee breaches often caused by seepage and instability before water is at the top of the levee
- Corps advocates design for water at the top of the levee and DWR supports this approach
- Seismic performance of levee systems has generally had low priority in the past
- Draft ULDC provides seismic criteria for frequently and intermittently-loaded levees

Questions / Comments?

6.0 Guiding Principles

Except for criteria specifically provided, the guidance for levee and floodwall design provided in the Corps Engineering Manuals, Engineering Technical Letters, Engineering Circulars, and Geotechnical Levee Practice SOP for the Sacramento District is considered to be applicable

- 6.1 General Principles
- 6.2 Geotechnical Design Principles
- 6.3 Hydrologic and Hydraulic Design Principles
- 6.4 Procedural Principles

Guiding Principles

- 6.1 General Principles
  - Two approaches to determine Design Water Surface Elevation can be used: (1) FEMA Approach or (2) Corps Approach
  - Right of Way should be adequate for O&M and expansion
  - With few exceptions, levee systems should be designed to perform without relying upon emergency actions, such as flood fighting
  - Urban levees should have flood safety plans and levee security plans

Guiding Principles

- 6.2 Geotechnical Design Principles
  - Levees should be designed for a factor of safety greater than 1.0 for stages up to the HTOL so that erosion from overtopping would be the expected mode of failure for extreme flood events
  - Seismic performance of levees during 200-year ground motions should be considered for existing levees as well as in the selection of all levee repair and improvement alternatives
  - Frequently loaded levees should have additional reliability, approaching that expected of dams

Guiding Principles

- 6.3 Hydrologic and Hydraulic Design Principles
  - Levee designs should not rely on other levees to fail or to be lower than authorized
  - Climate change and sea level rise should be considered
  - Levees should be designed as a system

Guiding Principles

- 6.4 Procedural Principles
  - Need independent expert review to avoid reliance on judgment of a single engineer or engineering firm
  - Finding should not last indefinitely -- 20-year term:
    - stability for urban planning
    - adaptive to evolving standards, hydrology, climate change, and performance changes
  - Flexibility to renew finding any time within 20 years
  - Periodic review of O&M needed
  - Exceptions allowed from prescribed criteria
  - Allowance for designs that were based on evolving criteria

9.0 References

- USACE and FEMA guidance
- Central Valley Improvement Framework
- SB 5
- EC 1110-2-6067, USACE Process for the National Flood Insurance Program
- Others

Questions / Comments?

Section 7 Overview

7.0	Urban Levee Design Criteria
7.1	*Design Water Surface Elevation*
7.2	*Minimum Top of Levee*
7.3	*Soil Sampling, Testing, and Analysis*
7.4	Slope Stability for Intermittently-Loaded Levees
7.5	Underseepage for Intermittently-Loaded Levees
7.6	Frequently-Loaded Levees
7.7	Seismic Vulnerability
7.8	Levee Geometry
7.9	*Interfaces and Transitions*
7.10	Erosion
7.11	Right-of-Way
7.12	Encroachments (Excluding Penetrations, Closure Structures, and Levee Vegetation)
7.13	Penetrations
7.14	Floodwalls, Retaining Walls, and Closure Structures
7.15	*Burrows*
7.16	Levee Vegetation
7.17	Wind Setup and Wave Runup
7.18	Security
7.19	Sea Level Rise
7.20	Emergency Actions
7.21	Levee Design Criteria Summary

Note: New subsections shown in *red italics*

What's New or Significantly Different in Section 7?

- Clarified "should" vs. "must"
- *Removed overtopping criteria for levees that are too low*
- Added technical criteria/guidance
  - superelevation
  - *freeboard levees*
  - sampling, testing, analysis
  - post-earthquake remediation plans
  - interfaces and transitions
  - *right of way and long-term acquisition plan*
  - encroachments and penetrations
  - control and remediation of animal burrows
  - *levee vegetation*
  - security plan and director
  - flood safety plan

Note: Especially challenging topics are shown in *italics*

7.1 Design Water Surface Elevation

- Use one of two options: (1) FEMA Approach, or (2) Corps Approach
- Median 200-year WSE
- Corps Approach also requires identifying:
  - uncertainty about median 200-year WSE
  - 90% and 95% assurance 200-year WSE
- For FEMA Approach, DWSE is median 200-year WSE + height adjustment
- For Corps Approach, DWSE is 90% assurance 200-year WSE + height adjustment
- Height adjustment considers superelevation, judgment, physical limits of regional flood system, and potential for other regional levee breaches to flood protected area and/or increase DWSE

7.1 Design Water Surface Elevation

- Bridges analyzed for potential debris loads and pressure flow and backwater if less than 3 feet of clearance
- Assumptions to make for other regional levees:
  - urban levees are 3 feet higher than median 200-year WSE
  - non-urbanized levees at higher of existing or authorized height
  - overtopped levees act as weirs without breaching

7.2 Minimum Top of Levee

- For FEMA Approach, MTOL is the higher of either:
  - DWSE + 3 feet
  - DWSE plus height for wind setup and wave runup
- For Corps Approach, MTOL is the lower of either:
  - the higher of (1) 90% assurance 200-year WSE, (2) median 200-year WSE + 3 feet, or (3) median 200-year WSE + height for wind setup and wave runup
  - the higher of (1) 95% assurance 200-year WSE, (2) median 200-year WSE + 2 feet, or (3) median 200-year WSE + height for wind setup and wave runup
- Need an exception if levee is lower than MTOL
- Freeboard levee should be considered under FEMA Approach
- Freeboard levee required under Corps Approach

7.3 Soil Sampling, Testing, and Logging

Based on DWR's experience in the Urban Levee Evaluation Program:

- take care to minimize sample disturbance, especially soft soils
- make sure consolidation test strain levels exceed virgin compression
- conduct strength tests with low confining pressures consistent with landside toe confining pressure
- use an appropriate field logging manual

7.4 Slope Stability (Intermittently-Loaded)

- FS ≥ 1.4 for DWSE
- FS ≥ 1.2 for HTOL
- HTOL = higher of A or B, where A is lower of (1) median 200-year WSE + 3 feet, (2) median 500-year WSE, or (3) MTOL, and B is the DWSE
- If HTOL is within 0.5 foot of DWSE, don't need to check stability for HTOL
- Normally use steady state phreatic surface
- Lower phreatic surface may be justified
- Remediate if phreatic line emerges on erodible slope
- Consider potential for progressive slope failure
- Check waterside slope stability for rapid drawdown

7.5 Underseepage (Intermittently-Loaded)

- $i_e \leq 0.5$ at levee toe for DWSE
- $i_e \leq 0.8$ at berm toe for DWSE
- Use FS for light blanket layer soils (< 112 pcf)
- Use judgment if i_e is high beyond 300 foot wide berm
- Allowable i_e through berm determined by interpolation
- $i_e \leq 0.6$ at levee toe for HTOL
- i_e not increase more than 20% beyond allowable i_e at toe of berm less than 100 feet wide for HTOL
- Use Corps guidance for interpolating allowable i_e in ditch unless assured it is filled with water
- Instrumentation and expandability of seepage berms

7.6 Frequently Loaded Levees

- Defined as levee with water one foot above landside levee toe once a day for more than 36 days per year
- Seepage control and crack stopping features like earth dams of similar height
- For landside slope stability analysis:
  - use steady state phreatic surface
  - FS ≥ 1.5 for DWSE
  - FS ≥ 1.3 for HTOL
- For rapid drawdown slope stability analysis:
  - FS ≥ 1.2 for DWSE to mean low-low tide
  - FS ≥ 1.4 for high-high tide to low-low tide (mean)
- Seismic stability requirements more stringent than for intermittently-loaded levees

7.7 Seismic Vulnerability

- Seismic analysis required, with 200-year ground motions
- Use typical summer and winter or mean high tide and low tide water levels
- Consider tsunami and seiche potential
- Use repair alternatives more resistant to seismic damage
- For intermittently-loaded levees, develop a post-earthquake remediation plan to restore 10-year protection levee geometry in 8 weeks
- Need the plan to consider quantities, sources, routes, etc
- For frequently-loaded levees:
  - maintain structural integrity
  - normally less than one foot of vertical settlement
  - less settlement where there are rigid penetrations
  - consider larger design ground motions

7.8 Levee Geometry

- New and reconstructed levees for major streams 3:1 slopes and 20-foot crown
- Bypass levees 4:1 waterside slopes
- Exceptions allowed where justified based on authorized geometry, performance history, constraints
- Extra-wide levees may have steeper slopes if slope stability criteria are met
- Extremely wide levees may deviate from slope stability criteria if analyzed with an appropriate remnant mass and progressive slope failure avoided
- Address need for access roads, turnouts, and ramps per Corps guidance and Title 23

7.9 Interfaces and Transitions

- Consider, evaluate, design for interfaces and transitions between different levee features
- Provide appropriate overlaps, transitions, and connections
- Avoid creating problems at these locations due to:
  - concentrated loads
  - 3-D effects

Questions / Comments?

7.10 Erosion

- Erosion hazard must be evaluated and addressed
- Repair levees likely to fail or be significantly damaged in a single event
- Consider annual erosion surveys by Corps and DWR
- Evaluate current condition based on projection of 3:1 waterside levee slope
- Follow Corps guidance
- Some Corps modeling may be available
- Consider whether dispersive soils may be present

7.11 Right of Way

- Provide adequate room for O&M and expansion
  - desirable to hold fee title from channel centerline to 20 feet beyond landside levee toe
  - 20-foot clear zone beyond landside levee toe
- Where too difficult to obtain in short-term, and area is *developed*, adopt long-term plan to:
  - acquire either minimum 10-foot clear zone for access or 20-foot visibility zone
  - provide realistic target schedule
  - consider higher FS to compensate for access/visibility limitations

7.11 Right of Way

- Where too difficult to obtain in short-term, and area is *undeveloped*, adopt long-term plan to:
  - acquire 20 feet beyond landside toe
  - provide realistic target schedule
  - adopt ordinance, building standards, etc. preventing incompatible construction within 20 feet of landside levee toe
- Provide, as practical, room for future expansion
  - future needs area, greater of 4 times levee height or 50 feet in addition to the 20-foot clear zone
  - no structures
  - uses compatible with seepage
- City/county restrictions on excavation and construction beyond future needs area, as far as 400 feet

7.12 Encroachments

- Assessed by civil engineer for hazard, considering:
  - type
  - age
  - condition
  - performance history
  - impacts on levee integrity, hydraulics, O&M
- High hazard encroachments removed or remediated
- Encroachments that are not high hazard must be permitted
- A plan for permitting, with realistic target schedule, is acceptable
- New encroachments to meet Corps/Board requirements and be properly permitted

7.13 Penetrations

- Typically, pipe crossings and transportation structures
- All penetrations assessed by civil engineer for hazard
- High hazard penetrations removed or remediated
- All penetrations to be properly permitted
- If uncertain whether there are unknown pipe penetrations, conduct study using geophysical methods
- Properly abandon penetrations
- Inspect or test pipes at least every 5 years
- New penetrations to meet Corps/CVFPB requirements:
  - should provide for video inspection capability
  - appropriate closure devices

7.14 Floodwalls, Retaining Walls, and Closure Structures

- Follow Corps guidance, considering it is changing
- Meet all global embankment stability, seepage, and underseepage criteria
- Use floodwalls and retaining walls only where a conventional earthen embankment is impractical
- Floodwalls preferred only on levee crest for freeboard
- Closure structures need to be identified for maintainer, location, permit, structure details, installation time, age, performance history
- Closure structures to be tested at least annually

7.15 Burrows

Follow Corps guidance, considering:

- networks of burrows can completely traverse a levee
- rodenticide-treated baits most economical
- DWR has found backfilling and grouting are effective
- levee dragging should occur *after* burrows repaired
- in short reaches, permanent barriers

7.16 Vegetation

- Life cycle management -- less stringent than Corps
- Conduct engineering inspection and evaluation and remove/remediate unacceptable threat to levee integrity
- Routine inspections to check for unacceptable threats
- Remove trees, alive or dead, that pose an unacceptable threat to levee integrity
- Remove roots > 1.5 inches at least 3 feet beyond stump, and more if appropriate, and properly backfill the excavation
- Immature trees less than 4 inches DBH generally don’t need root removal
- New levees to meet Corps guidance, with trees allowed on specially designed planting berms

7.16 Vegetation

- Figures/definition for vegetation management zone (VMZ):
  - levee crown and landside levee slope
  - within 15 feet of landside levee toe (or easement)
  - upper 20 feet of waterside levee slope (with exceptions for short levees)
- Trees removed for repair/improvement not to reestablish within VMZ
- Trimming and thinning for visibility/access in VMZ
- Life cycle management applies in VMZ:
  - remove immature tress (< 4 inches DBH)
  - may allow larger trees to remain
  - periodically evaluate remaining trees, alive and dead

7.16 Vegetation

- As part of any levee improvement program, levee maintaining agencies are encouraged to preserve trees in VMZ by:
  - widening the levee landward at least 15 feet
  - installing an effective root barrier in the upper 10-15 feet of the levee
- Trees outside of the VMZ need not be managed, except to extent they pose an unacceptable threat to levee integrity

7.17 Wind Setup and Wave Runup

- Add wind setup & wave runup to median 200-year WSE
- Used for determining minimum top of levee or floodwall
- Used for erosion protection design
- Discretion to use Corps, FEMA, EurOtop guidance
- Wind speed:
  - based on Sacramento River bank protection design
  - 50% chance of non-exceedance in 50 years
  - return period of 72.6 years (0.0138 annual chance)
  - one hour or less duration for levee/floodwall height
  - duration causing significant erosion for armoring
- Limited overtopping allowable, typically 0.01 to 0.1 cfs/ft
- Method based on open water – excessive wave heights can be calculated – required freeboard normally ≤ 6 feet

7.18 Security

- Security Plan and Director to protect against terrorism and vandalism, based on vulnerabilities, using:
  - networked detection
  - deterrence
  - physical security
  - intrusion interdiction
- Networked Detection:
  - sharing information between LMA and intelligence community
  - suspicious activity reporting thru SARS
  - partnership with citizens accessing the levee
  - training for personnel through InfraGard and Cal-EMA's Homeland Security Information Network – Critical Sectors

7.18 Security

- Deterrence:
  - locked gates
  - signs
  - patrols
- Physical Security:
  - access control (gates, barriers, sensors)
  - intrusion detection (cameras, motion detectors)
  - levee performance (sensors)
- Intrusion Interdiction:
  - swift response to intrusions
  - planning efforts (e.g., workshops, exercises)
- Resources

7.19 Sea Level Rise

- Assess for the duration of the finding (20 years), for example – if one inch rise calculated for next 20 years, then design for at least one inch rise
- Consider a range of estimates
- Prepare for future expansion and structural raise for long-term sea level rise
- Ocean Protection Council's March 11, 2011 guidance
- EC 1165-2-211 provides Corps guidance

7.20 Emergency Actions

- Normally may not be relied upon for making a finding
- Exceptions allowed for closure structures and flood relief structures
- Flood relief structure plan in O&M Manual and/or EAP:
  - specified triggers, procedures, responsible agencies
  - only used to limit extent and depth of flooding
  - must be feasible for all levee failure scenarios
  - pumping plants designed to operate for full depth
  - relief cuts need location, dimensions, equipment (may not rely on water to help)
  - identify hydraulic impacts
  - relief cuts may lower flooding to levee crown elevation

7.20 Emergency Actions

- Flood Safety Plan required
- Sample Flood Safety Plan available, with components including:
  - organization and assignment of responsibilities
  - direction, control, coordination, and communications
  - administration, finance, and logistics
  - plan development and maintenance
  - authorities and maintenance
  - flood fight plan element
  - floodwater removal element
  - evacuation plan
  - requirements for siting new essential facilities
  - levee patrol element

7.21 Levee Design Criteria Summary

Table 7-2. Levee Design Criteria Summary for Intermittently-Loaded Levees

Parameter	Criteria			
DWSE (Option 1)	Median 200-year WSE			
DWSE (Option 2)	90% assurance 200-year WSE			
MTOL (Option 1)	Median 200-year WSE + higher of (1) 3 feet, or (2) height for wind setup and wave runup			
MTOL (Option 2)	Lower of A or B, where: • A is the higher of (1) 90% assurance 200-year WSE, (2) median 200-year WSE plus three feet, or (3) median 200-year WSE plus height for wind setup and wave runup • B is the higher of (1) 95% assurance 200-year WSE, (2) median 200-year WSE plus two feet, or (3) median 200-year WSE plus height for wind setup and wave runup			
HTOL (Option 1)	Lower of (1) median 200-year WSE plus three feet, or (2) median 500-year WSE			
HTOL (Option 2)	Higher of A or B, where: • A is the lower of (1) median 200-year WSE plus three feet, (2) median 500-year WSE, or (3) MTOL (Option 2) • B is the DWSE			
Seepage - Exit Gradient at Levee Toe	For DWSE		For HTOL	
	γ ≥ 112 pcf	γ < 112 pcf	γ ≥ 112 pcf	γ < 112 pcf
	i ≤ 0.5	FS ≥ 1.6	i ≤ 0.6	FS ≥ 1.3
Seepage - Exit Gradient at Seepage Berm Toe	i ≤ 0.8	FS ≥ 1.0	<20% FS degradation for berms less than 100 feet	<10% FS degradation for berms less than 100 feet
Steady State Slope Stability	FS ≥ 1.4		FS ≥ 1.2	
Seismic Vulnerability	Restore grade and dimensions for at least 10-year WSE plus three feet of freeboard or higher for wind setup and wave runup within eight weeks			
Levee Geometry	For new or extensive reconstruction on a major stream, minimum 20-foot-wide crown, 3h:1v waterside and landside slopes for all levees except bypass levees (4h:1v waterside slope)			

Note: The median 200-year WSE, the 90 percent assurance 200-year WSE, and the 95 percent assurance 200-year WSE in this table are assumed to have been increased appropriately to account for the potential for new, updated hydrology to yield higher flows.

7.21 Levee Design Criteria Summary

Table 7-3. Levee Design Criteria Summary for Frequently-Loaded Levees

Parameter	Criteria	
	For DWSE	For HTOL
Steady State Slope Stability	FS ≥ 1.5	FS ≥ 1.3
Minimum Allowable Rapid Drawdown Slope Stability	FS ≥ 1.2	
Frequent, Large, Tidal Fluctuations Rapid Drawdown Slope Stability	FS ≥ 1.4*	
Seismic Vulnerability	No significant deformation, usually limited to three feet maximum with one foot of vertical settlement.	

Notes:
These criteria are additions or exceptions to the criteria presented for intermittently-loaded levees.
*Applies for the range of tidal fluctuation, not the DWSE

Key:
DWSE = design water surface elevation
FS = factor of safety
HTOL = hydraulic top of levee

Questions / Comments?

8.0 Operation, Maintenance, Inspection, Monitoring, and Remediation of Poor Performance

- Corps standard O&M and inspection requirements apply
- Engineers must incorporate features that provide for prompt identification of distress after or during an event
- Remediation may be needed based on either instrumentation readings or poor field performance during high water conditions
- Flood Safety Plan and Levee Security Plan

Attachment 1 -- Draft Procedures

- Procedure for Finding that Facilities Provide the Urban Level of Flood Protection
- Substantial Evidence in the Record
- Exceptions
- Periodic Review
- Independent Expert Panel

(Draft) Procedure for Finding that Facilities Provide an Urban Level of Flood Protection

- Urban (200-year) level of flood protection finding prior to:
  - development agreement
  - discretionary permit, entitlement, ministerial permit
  - tentative map, parcel map w/o tentative map, subdivision that relies on levee or floodwall
- City or county makes the finding
- Applies to a levee reach and specific source of flooding
- May apply to a specific area
- Based on Substantial Evidence in the Record
- Expires after 20 years
- Renewable at any time

(Draft) Substantial Evidence in the Record

- Civil engineer's initial draft report for independent expert panel's review
- Independent expert panel's peer review report
- Civil engineer's draft report for 30-day agency/public review
- Civil engineer's final report
- Expert panel's letter (if previously did not concur)
- Documentation and panel's concurrence on exceptions to the criteria
- City or county finding based on documentation
- City or county should post finding and evidence

(Draft) Exceptions

- Adaptive to site-specific issues
- Documented concurrence of:
  - civil engineer
  - independent expert panel
- 30-day agency/public review
- Upon request, DWR may opine on need

(Draft) Periodic Review

- 5-year term
- City/county determination within 6 months of civil engineer's report on O&M
- Determinations by civil engineer:
  - operations and maintenance is adequate
  - integrity of levee has not degraded below urban criteria
  - no significant physical change has occurred
  - if degraded, the level of protection remaining (if possible)
- City/county conditional determination if degraded:
  - scope of O&M or damage issues
  - plan, schedule, cost of remediation
  - funding
  - interim public safety measures
  - responsible parties for implementation
- Must remediate before subsequent periodic review

(Draft) Independent Expert Panel

- USACE EC 1165-2-209, January 31, 2010:
  - Type II External Peer Review
  - independent experts
- Minimum of three experts:
  - one expert in H&H
  - two experts in levee/floodwall design and construction as appropriate for project
  - if appropriate, one expert in floodplain mapping
- At least one new levee/floodwall expert (compared to prior panel)

Questions / Comments?

Conclusion

- Written comments due December 15, 2011
- Address comments to:

  Rodney Mayer
  3310 El Camino Avenue
  Suite 120
  Sacramento, CA 95821
- Comments will be considered for final ULDC
- FloodSAFE California website

THANK YOU!

Levee Vegetation Management Zone

(page 7-31)

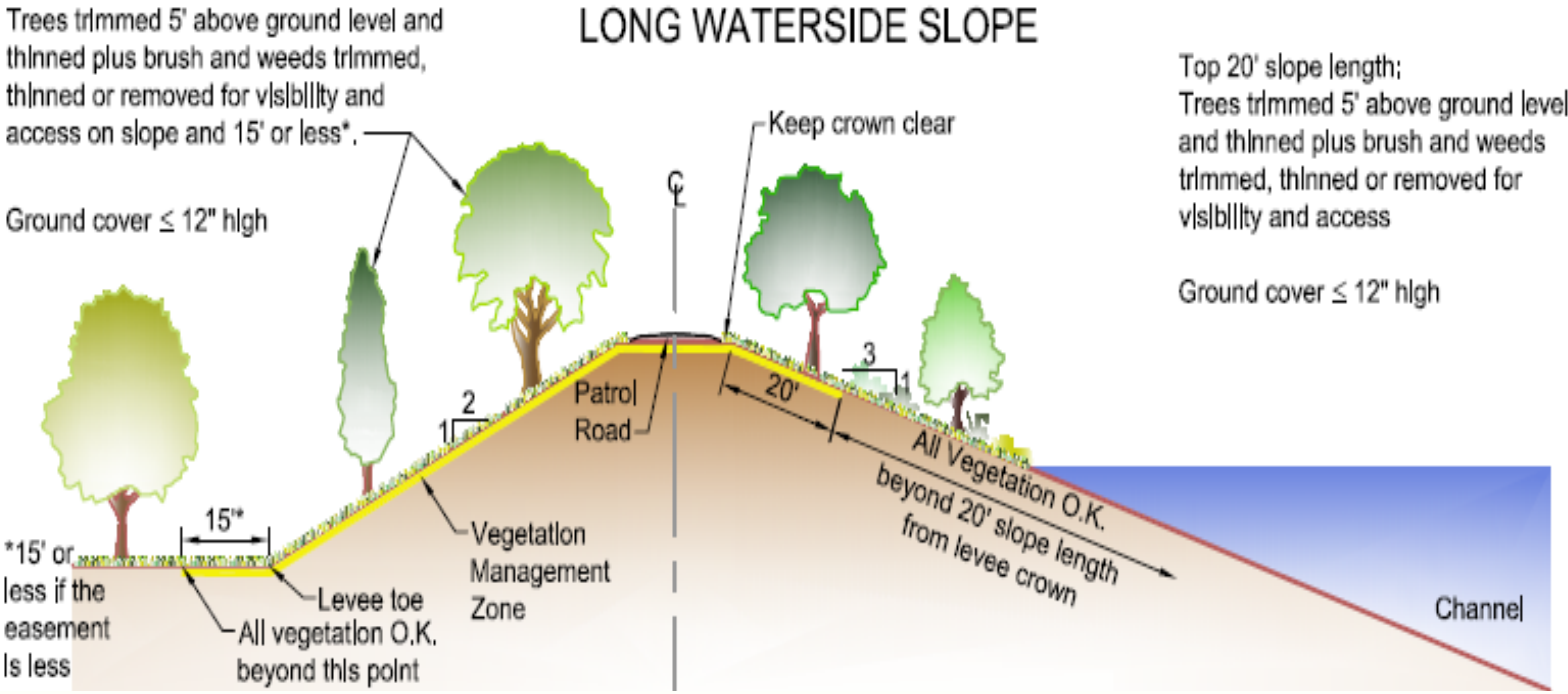


Figure 7-4. Vegetation Management for Levees with a Long Waterside Slope

Levee Vegetation Management Zone

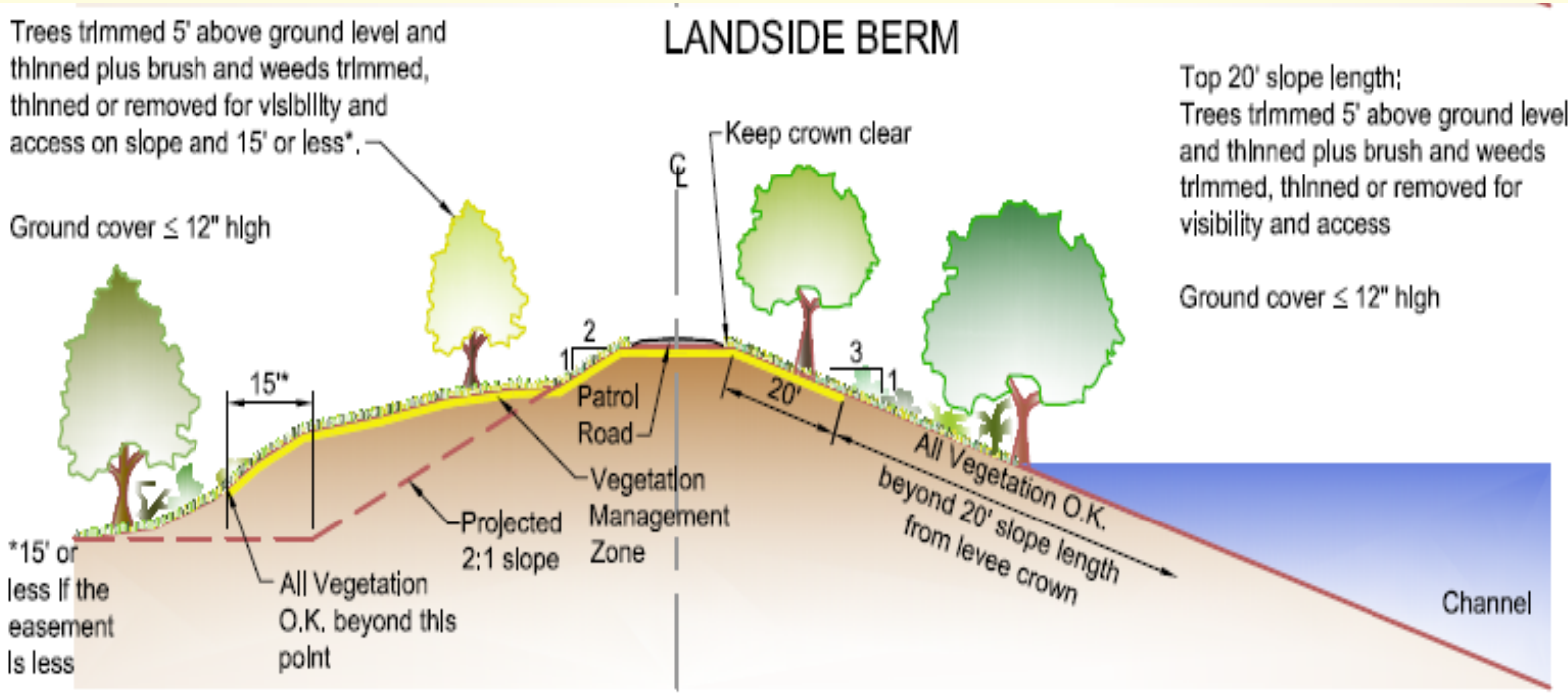


Figure 7-5. Vegetation Management for Levees with a Landside Berm

Levee Vegetation Management Zone

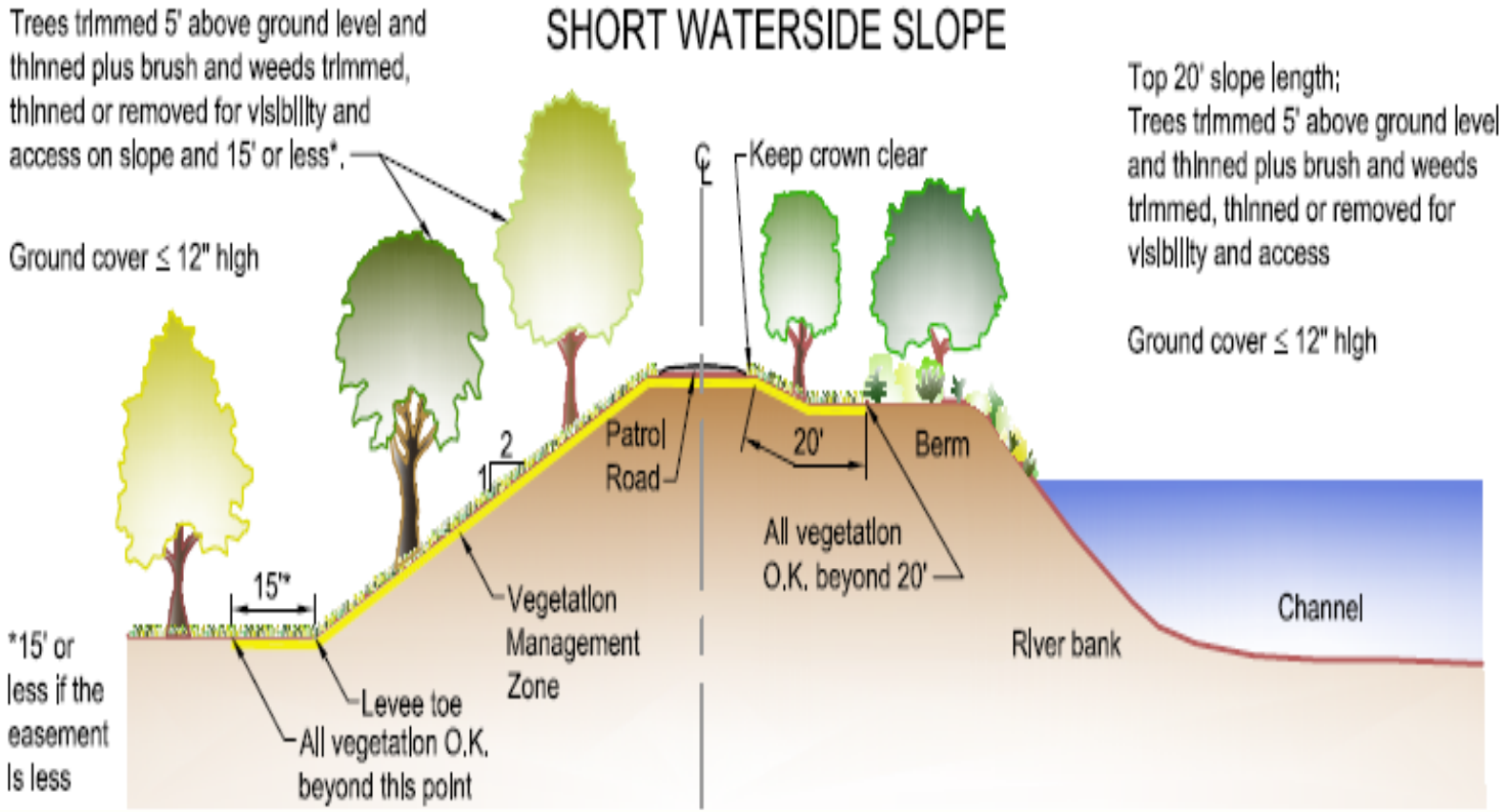


Figure 7-6. Vegetation Management for Levees with a Short Waterside Slope

Levee Vegetation Management Zone

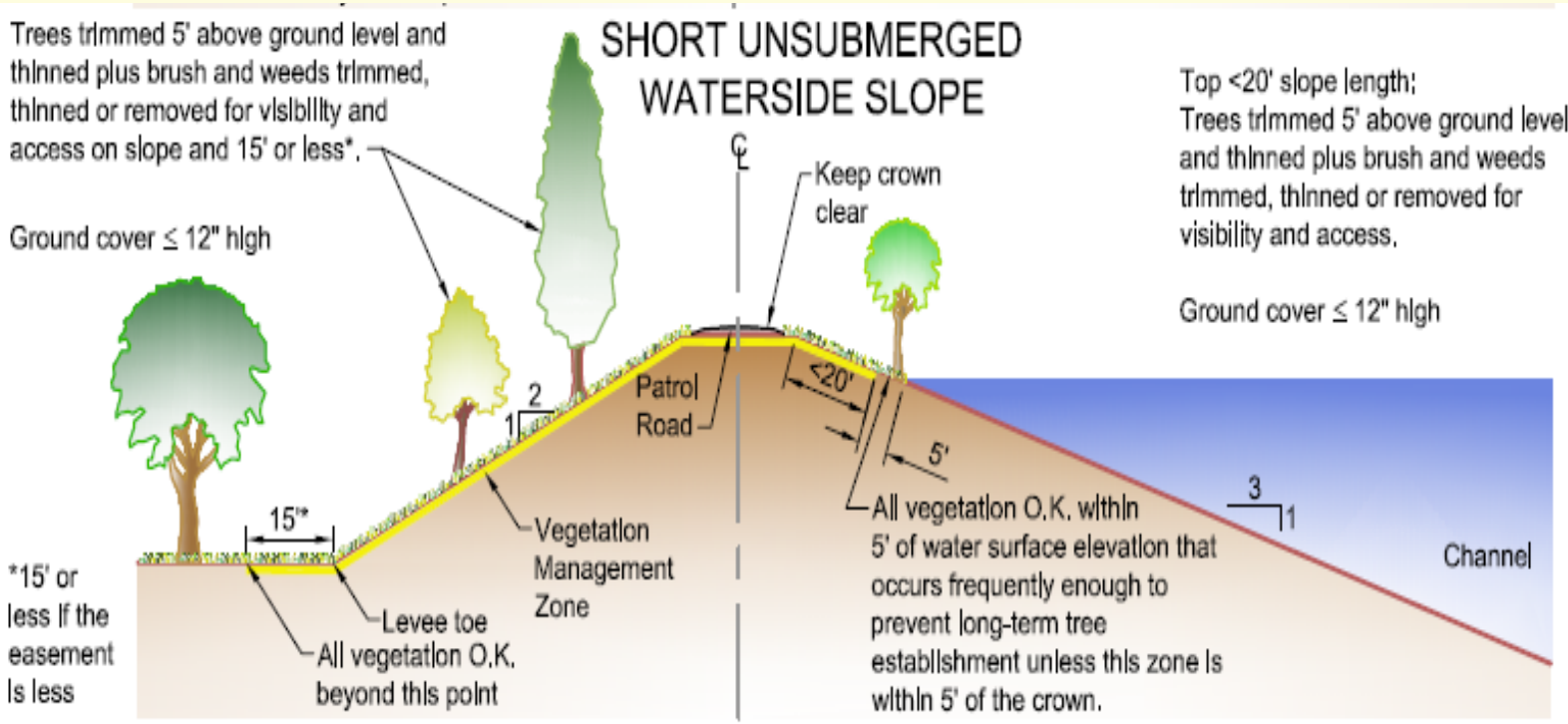


Figure 7-7. Vegetation Management for Levees with a Short Waterside Slope above the Water Surface Elevation that Frequently Submerges the Lower Waterside Slope